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Forest insect and disease conditions in Alberta, Saskatchewan, Manitoba, and the Northwest Territories in 1984 and predictions for 1985

B.H. Moody and H.F. Cerezke

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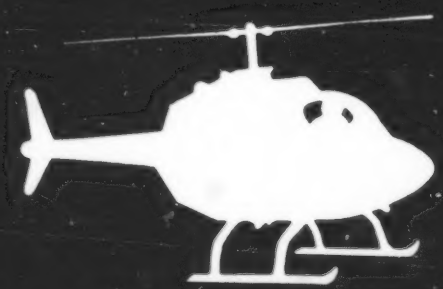
Northern Forest Research Centre



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FOREST INSECT AND DISEASE CONDITIONS IN ALBERTA, SASKATCHEWAN, MANITOBA, AND THE NORTHWEST TERRITORIES IN 1984 AND PREDICTIONS FOR 1985

B.H. MOODY AND H.F. CEREZKE

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ABSTRACT

Forest pest conditions in Alberta, Saskatchewan, Manitoba, and the Northwest Territories during 1984 are summarized, and some predictions are made for 1985. Eleven major pests are discussed in detail, and additional noteworthy insects, diseases, and other damage agents are reported in a table. Spruce budworm outbreaks continued to increase in white spruce-balsam fir stands in the region. Total area of moderate-to-severe defoliation increased to 170 200 ha. The jack pine budworm infestations in Manitoba increased significantly and moderate-to-severe defoliation of jack pine occurred over 761 000 ha. New outbreaks of the jack pine budworm resulted in the defoliation of 27 000 ha of jack pine stands in Saskatchewan. Infestations of the mountain pine beetle continued to decline and about 224 700 lodgepole pines were killed, mainly in southwestern Alberta. Mortality of mature white spruce caused by the spruce beetle declined and was reported only in a few small areas in northern Alberta. Forest tent caterpillar infestations declined significantly and moderate-to-severe defoliation occurred within 1 412 600 ha in the prairie provinces. Dutch elm disease continued to spread in rural Manitoba where it was identified in three additional municipalities. The mountain ash sawfly, an introduced pest, was collected for the first time in Manitoba, and a male gypsy moth was trapped for the first time in Alberta.

RESUME

Ce document présente la situation des ravageurs forestiers en Alberta, en Saskatchewan, au Manitoba et dans les Territoires du Nord-Ouest en 1984 et esquisse quelques prévisions pour 1985. Il comprend l'étude détaillée de 11 grands ravageurs ainsi qu'un tableau énumérant les autres insectes, maladies ou agents d'endommagement dignes de mention. Les invasions de la tordeuse des bourgeons de l'épinette se sont encore accrues dans les peuplements d'épinette et de sapin baumier de la région. La superficie totale modérément à gravement défoliée est passée à 170 200 ha. Au Manitoba, l'infestation de la tordeuse du pin gris s'est accentuée de beaucoup et 761 000 ha de pin gris ont été défoliés modérément à gravement. En Saskatchewan, de nouvelles invasions de la tordeuse de pin gris ont entraîné la défoliation de 27 000 ha de pin gris. L'infestation par le dendroctone du pin ponderosa diminue toujours; environ 224 700 pins tordus ont été tués, surtout dans le sud-ouest de l'Alberta. On a constaté un déclin de la mortalité causée par le dendroctone de l'épinette chez l'épinette blanche arrivée à maturité: on n'en a signalé que dans quelques endroits limités du Nord de l'Alberta. Les infestations de la livrée des forêts ont beaucoup diminué: il y a eu défoliation modérée à grave sur moins de 1 412 600 ha dans les provinces des Prairies. Dans les campagnes manitobaines, la maladie hollandaise de l'orme continue à s'étendre: elle a été signalée dans trois autres localités. Ravageur importé, la tenthrède du sorbier a été trouvée pour la première fois au Manitoba. En Alberta, on a capturé, pour la première fois, un spécimen mâle de spongieuse.

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NOTE

The exclusion of certain manufactured products does not imply rejection nor does the mention of other products imply endorsement by the Canadian Forestry Service.

INTRODUCTION

This report summarizes forest insect and disease conditions in Alberta, Saskatchewan, Manitoba, and the Northwest Territories in 1984 and provides predictions of the infestation levels of major insect pests for 1985. Surveys were conducted mainly by the staff of the Forest Insect and Disease Survey (FIDS) of the Northern Forest Research Centre, Canadian Forestry Service (CFS), with the cooperation of personnel from many federal, provincial, and municipal agencies.

We would like to acknowledge the assistance and cooperation of many individuals from the following agencies:

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City of Edmonton
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Saskatchewan Agriculture
Saskatchewan Department of Tourism and Renewable Resources
Canada Department of Indian Affairs and Northern Development

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Five summer students (Joe Helwig, Tarra Kongsrude, Candace Liard, Richard Paquin, and Margaret Smith) also worked for FIDS in 1984.

The following descriptions of pests are arranged more or less according to national and regional importance. Brief remarks on other noteworthy insects, diseases, and vegetation disturbances appear in the table on pages 17–21.

SPRUCE BUDWORM
Choristoneura fumiferana (Clemens)

The number of spruce budworm outbreaks increased in Manitoba, Saskatchewan, Alberta, and the Northwest Territories in 1984 (Fig. 1). These outbreaks were scattered over a total area of 170 200 ha compared to 66 000 ha in 1983 (Table 1). No sizable control

Table 1. Summary of moderate-to-severe defoliation by the spruce budworm sketch-mapped from the air during 1983-84

Area	Defoliation (ha)		
	1983	1984	Change
Manitoba	40 500	142 700	+102 200
Saskatchewan	12 700	15 100	+2 400
Alberta	1 000	1 500	+500
Northwest Territories	11 800	10 900	−900
Total	66 000	170 200	+104 200

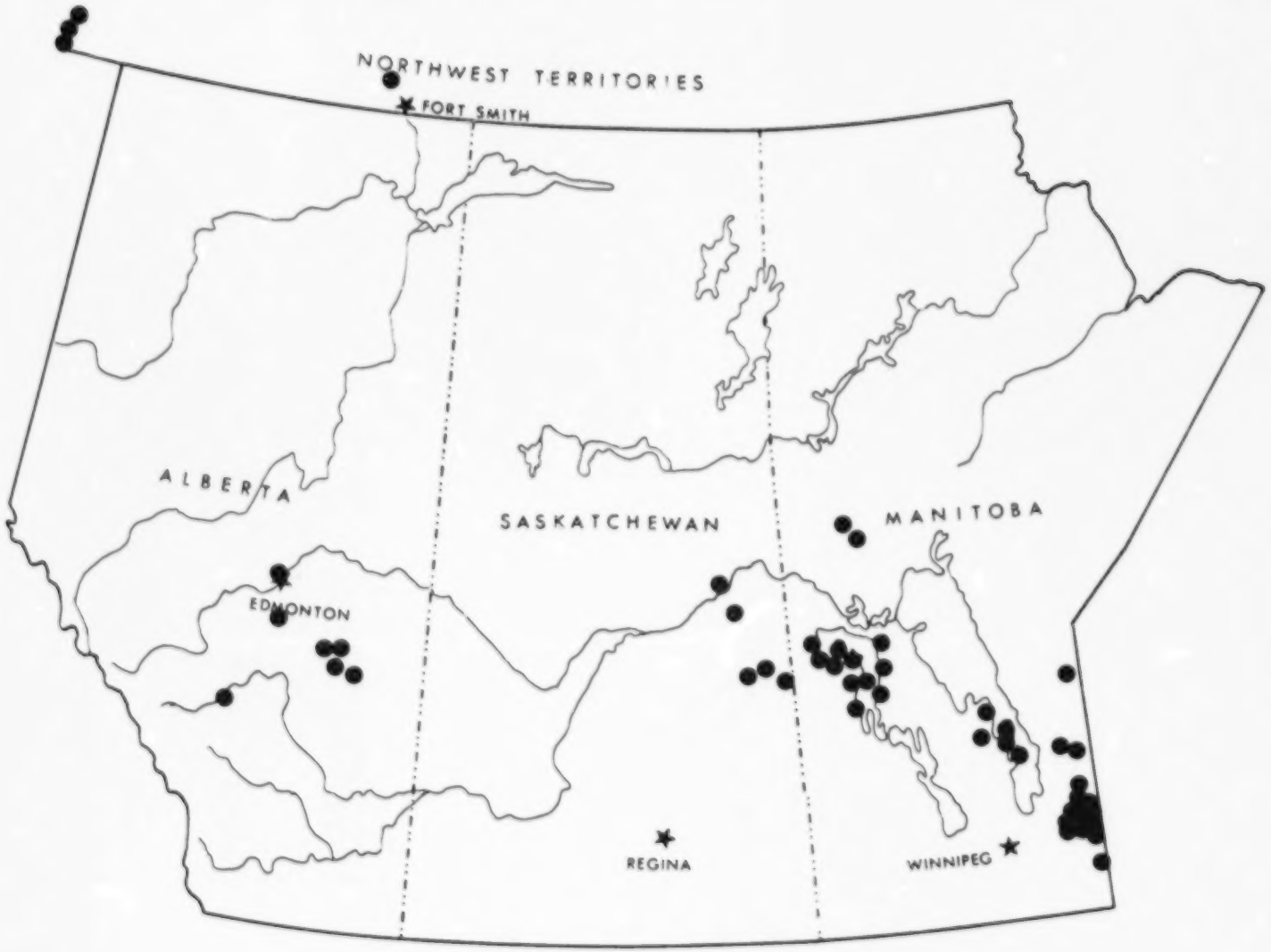

Figure 1. Areas of moderate-to-severe defoliation by the spruce budworm in 1984.

operation was carried out against the spruce budworm in the region, except for the application of Dipel 88 (*Bacillus thuringiensis* (Berliner) (B.t.)) in small areas in central Alberta. The general forecast for 1985, based on egg-mass counts in the fall of 1984, is for moderate-to-severe defoliation to occur in the same general areas. Weather, parasites, predators, and diseases may affect the predicted infestation levels.

Manitoba: In 1984, an estimated total of 142 700 ha of moderately to severely defoliated white spruce and balsam fir stands were mapped in the province. Increased aerial surveillance detected a three-fold increase in the infested area compared to that reported in 1983. The total areas of moderate-to-severe defoliation estimated by provincial regions, were as follows:

Eastern (east of Lake Winnipeg and the Red River)	65 800 ha
Interlake (between Lake Winnipeg and Lake Manitoba)	41 900 ha
Lake Winnipegosis	33 400 ha
Northwestern (The Pas north)	1 600 ha

Tree mortality is less than 25% in stands scattered over 5000 ha of spruce-fir forests where outbreaks began as early as 1977 in the Eastern and Interlake regions. Up to 90% of the balsam fir component of these stands is dead in Whiteshell Provincial Park, on the east side of Lake Winnipeg, and in the southern Interlake Region. Near Lac du Bonnet mixed white spruce-balsam fir forests are now declining from repeated spruce budworm attack. Accelerated harvesting to salvage the damaged timber has been recommended by the Forestry Branch, Manitoba Department of Natural Resources.

In eastern Manitoba, the outbreak in Whiteshell Provincial Park first appeared in 1978 near Nutimik and Eleanor lakes. In 1984, moderate-to-severe defoliation of spruce-fir stands occurred on 57 500 ha scattered throughout Whiteshell Provincial Park and north as far as Cat Lake in Nopoming Provincial Park. The Wanipigow-Long Lake outbreak, first reported in 1979, was estimated at 7800 ha in 1984, extending along the Wanipigow River from Wanipigow Lake east to Wallace Lake, south to Stormy Lake, and along the Manigotagan River from Quesnel Lake to Long Lake. A small outbreak (<500 ha) was detected in 1984 in the Family Lake area.

In the Interlake region, outbreaks that began in 1978 or earlier and persisted in 1984 included: those in the Grindstone Provincial Recreation Area (11 100 ha); along Beaver Creek (2800 ha); at St. George, St. Andrew, and Evenflow lakes (21 800 ha); and near Mantagao Lake (3900 ha).

The Hecla Provincial Park outbreak has persisted for several years and moderate-to-severe defoliation occurred on 1800 ha. An outbreak (less than 500 ha) at Ramsay Point on the west side of Washaw Bay was detected for the first time in 1984.

The current outbreaks around Lake Winnipegosis were first detected during aerial surveys in 1979. Twelve distinct outbreak areas detected in 1984 totaled 33 400 ha (ranging in size from 300 to 12 400 ha) and included Cameron Bay, Smith Point-Whitefish Point, Salt Point, Pelican Rapids, Pelican Bay-Big Bay, Pelican Lake, Denbeigh Point, Point La Ronde, Birch Island, Inland Lake, and Camperville.

In northern Manitoba, moderate-to-severe defoliation of white spruce-balsam fir occurred over 1000 ha in the Wekusko Falls-Grass River area. This outbreak was first detected in 1979. Small new outbreaks were detected near Betty Lake and Atikameg Lake.

Egg-mass sampling at 20 locations, conducted by the CFS and the Manitoba Department of Natural Resources, and moth counts from pheromone-baited traps indicate that moderate-to-severe defoliation may occur in 1985 in Whiteshell Provincial Park, at the north end of Hecla Island, in the Grindstone Provincial Recreation Area, near Lake St. George and Lake St. Andrew, and around the north end of Lake Winnipegosis (Table 2). No change or decline is expected in the infestations at Wanipigow lake and the Wallace Lake area. Populations will remain low or at endemic levels in Birds Hill, Sprucewoods, and Duck Mountain provincial parks and the Rock Lake and Simonhouse areas.

Saskatchewan: Moderate-to-severe defoliation of white spruce-balsam fir forests increased slightly from 12 700 ha in 1983 to 15 100 ha, as additional outbreaks were detected in 1984.

The Usherville- Tall Pines outbreak, first detected in 1982, decreased slightly in intensity; however, moderate-to-severe defoliation of scattered host stands still persisted over approximately the same total area of

Table 2. Average spruce budworm egg-mass densities in 1984 and predicted 1985 damage for Manitoba, Saskatchewan, and Alberta

Location	Egg mass per 10 m² of foliage		1985 damage forecast[a]
MANITOBA			
Interlake region			
Moosehorn	—	(6)[b]	—
Waterhen	—	(540)	—
Lake St. George (6 locations)	115	(114)	Moderate
Lake St. Andrew (4 locations)	100	(132)	Moderate to severe
Hecla Island Provincial Park (11 locations)[c]	162	(206)	Severe
Southeastern Manitoba			
Lac du Bonnet (5 locations)	247		Severe
Bird Lake, Tahabi Falls	—	(143)	—
Whiteshell Provincial Park	—	(294)	
Big Whiteshell Lake area (6 locations[c])	77	(286)	Moderate
Grindstone Point Provincial Park (7 locations)[c]	88	(141)	Moderate
Birds Hills Provincial Park	—	(6)	—
Red Deer River	120		Moderate to severe
Wanipigow Lake	13		Light
Wallace Lake	25		Light
Northern Manitoba			
Wekusko Lake	—	(481)	—
Riding Mountain National Park (3 locations)	—	(0)	Nil
Spruce Woods Provincial Park	—	(0)	Nil
Duck Mountain National Park	17	(0)	Light
SASKATCHEWAN			
Near Usherville	157	(221)	Moderate to severe
Red Earth	223	(459)	Severe
Porcupine Provincial Forest			
South boundary	475		Severe
North boundary	118		Moderate to severe
Shoal Lake	33		Light to moderate
Hudson Bay	0		Nil
ALBERTA			
Edmonton	—	(96)	—
Millet	295	(1661)	Severe
Duhamel Campground	—	(22)	—
Dubois Valley	—	(372)	—
Big Knife Provincial Park	239	(175)	Severe
Castor	253	(550)	Severe

[a] Egg mass per 10 m² and potential defoliation:
Light = Up to 25 = >25% defoliation
Moderate = 50-100 = 26-50% defoliation
Severe = 200+ = 50+% defoliation

[b] Figures in brackets are for 1983.

[c] Source: Beaubien, Y. 1984. Spruce budworm egg mass survey, 1984. Manit. Dep. Nat. Resour., For. Branch. Winnipeg, Manit. Rep. 84-5.

4800 ha. The Red Earth outbreak northeast of Carrot River, detected in 1983, remained at approximately the same intensity and moderate-to-severe defoliation occurred over a total area of 7900 ha. As a control measure, timber harvesting was redirected to these areas in 1984 and may have contributed to a decrease in budworm population levels.

Two additional outbreaks were detected in 1984 in the Porcupine Provincial Forest. Moderate-to-severe defoliation was recorded in the vicinity of the Woody River road at the south boundary (400 ha) and east of Parr Hill Lake near Little Swan-Tennant Lake roads (1000 ha). Moderate-to-severe defoliation also occurred along the Torch River (1000 ha) just east of the junction with the Missipuskiow. This outbreak occurred a few years before its detection in 1984. Elsewhere, similar defoliation was recorded on white spruce in a farm woodlot (10 ha) northeast of Preeceville and light-to-moderate defoliation was found near Hyas (3 ha).

Egg-mass counts at four locations within the major outbreak areas and pheromone trapping of male budworm moths indicated that moderate-to-severe defoliation may occur in the Red Earth, Usherville, and Porcupine provincial forest infestations (Table 2).

Alberta: The spruce budworm caused varying levels of damage in several white spruce stands in central Alberta in 1984. Moderate-to-severe defoliation was detected in six locations: along Pipestone Creek near Millet (250 ha), 10-15 km south of Millet along Bigstone Creek (50 ha), along the Battle River east of Donalda (50 ha), the Dubois Valley area along Bigstone Creek southwest of Big Knife Provincial Park (100 ha), Big Knife Provincial Park (10 ha), and along Castor Creek northeast of Castor (200 ha) (Fig. 1).

Patches of light-to-moderate defoliation were detected west of Bowden in Red Lodge Provincial Park and along Highways 5 and 7 east of the Red Deer River crossing. In Edmonton, light and moderate defoliation occurred along the North Saskatchewan river valley and in other planted spruce areas in the city.

The bacterial insecticide B.t. in its commercial form, Dipel 88, was applied to white spruce in the Edmonton, Millet, and Castor areas for spruce budworm control, with varying levels of success. Egg-mass counts taken from several locations in the infested areas in central Alberta suggest medium to high populations will occur in 1985 (Table 2).

Northwest Territories: For the third year, moderate-to-severe spruce budworm defoliation was mapped over 9700 ha of white spruce stands along the Liard River in the western Mackenzie district from the border with British Columbia to 150 km north. In the eastern Mackenzie district, moderate-to-severe defoliation (1000 ha) of white spruce occurred for the second year on Long Island and the adjacent valley in the Slave River, a slight decline over last year. No egg-mass survey was conducted, but pheromone traps were saturated with male spruce budworm moths, indicating that the infestation will likely continue in 1985.

JACK PINE BUDWORM
Choristoneura pinus pinus Freeman

The jack pine budworm infestations in Manitoba increased significantly in 1984 and extensive new outbreaks occurred in Manitoba and Saskatchewan. Moderate-to-severe defoliation occurred over 788 000 ha of jack pine forests in these provinces (Fig. 2).

In **Manitoba**, moderate-to-severe defoliation of jack pine occurred over an estimated total area of 761 000 ha, almost five times the area infested in 1983. The outbreak in northwestern Manitoba began in 1982 north of Grand Rapids and in 1984 extended from north of Gypsumville, between Lake Winnipegosis and Lake Winnipeg, northwesterly to The Pas and Sturgeon Landing, along the Manitoba-Saskatchewan border as far north as Kapihagan Lake, and northeasterly to Heaman and Highrock and Apigamon lakes (652 000 ha).

Two new major outbreaks were detected (east of Lake Winnipeg) in 1984. The first outbreak (86 800 ha) extended from Kettle Falls north to Marchand Lake, and east along the Poplar River to Harrop and Morfee lakes. The second outbreak (21 800 ha) extended from the confluence of the Gammon and Bloodvein rivers to Aikens Lake, and east to the Manitoba-Ontario border between Artery and Craven lakes.

In southeastern Manitoba, jack pine and Scots pine plantations in the Spruce Woods Provincial Forest (less than 600 ha) sustained moderate-to-severe defoliation for the first time since 1979.

Egg-mass sampling was conducted at 20 jack pine locations across the province and moderate-to-severe defoliation is expected to occur in 1985 throughout the

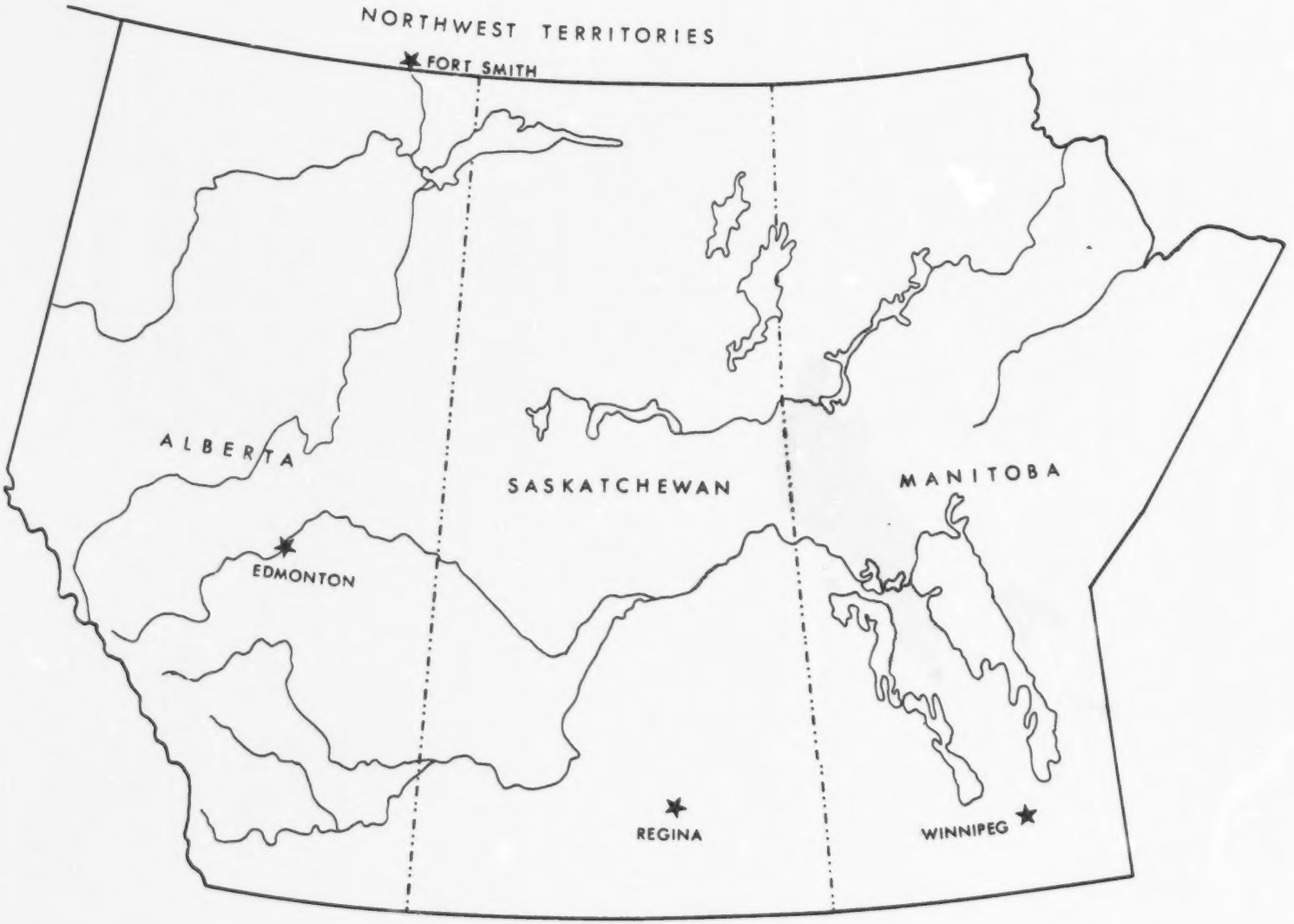

Figure 2. Areas of moderate-to-severe defoliation by jack pine budworm in 1984.

outbreak areas, with possible southward expansion from Aikens Lake in eastern Manitoba to at least Wallace Lake. Light-to-moderate defoliation is predicted for the Rosenburg area of the Interlake region.

In **Saskatchewan**, new outbreaks of the jack pine budworm were detected along the eastern border of the province (Fig. 2). The last major outbreak in Saskatchewan collapsed in 1979. The western perimeter of the major area of moderate-to-severe defoliation of jack pine extended from about 60 km north to 40 km south of Flin Flon and 15-20 km into Saskatchewan, covering an estimated 26 000 ha (Fig. 2). Small outbreaks of similar defoliation were observed at the southern outskirts of Hudson Bay (200 ha) and in the Nipawin-Tobin Lake area (600 ha).

Egg-mass counts at 11 locations indicate that moderate-to-severe defoliation may occur in 1985 in the Nipawin Lake, Hudson Bay, and Denare Beach areas and between Creighton and Johnson Lake (Table 3). Weather, parasites, and the lack of male flowers, which are the preferred food of the young larvae, can affect these predicted infestation levels.

ASPEN DEFOLIATORS
Primarily the forest tent caterpillar (*Malacosoma disstria* Hübner) and the large aspen tortrix (*Choristoneura conflictana* (Walker))

Aerial and ground surveys indicated that the total area of aspen forests severely defoliated in 1983 declined substantially in Alberta, Saskatchewan, and Manitoba (Fig. 3). Moderate-to-severe defoliation of aspen and other deciduous tree species was mapped over a total area of 1 412 600 ha in the region, two-thirds of which occurred in the agricultural zones in Alberta and Saskatchewan. The forest tent caterpillar was again the major defoliator species across the region, except in the Northwest Territories and Wood Buffalo National Park, where the large aspen tortrix predominated. The Bruce spanworm, *Operophtera bruceata* (Hulst), the early aspen leaf curler, *Pseudexentera oregonana* (Walsingham), and the linden looper, *Erannis tiliaria* (Harr.) were present but caused noticeable defoliation only in a few small areas.

In **Manitoba**, the forest tent caterpillar was again the major defoliator of trembling aspen, while late spring frost injury of foliage was extensive, particularly in the western half of the province. Moderate-to-severe defoliation occurred on 76 900 ha of aspen forest scattered over a total area of 634 000 ha in northwestern Manitoba. The main outbreak was centered around Moose Lake and scattered through an area roughly bounded by Landry Lake, Hargrove Lake, Little Limestone Lake, and the Moose Lake settlement (60 300 ha). New outbreaks were detected between Buffalo Lake and Grand Rapids (3600 ha), representing a southerly shift of the main infestation area. Elsewhere, scattered patches of similar defoliation occurred in the Namew-Rocky lakes area (4700 ha), west of Goose Lake (1600 ha), east of White Lake (300 ha), south of Elbow Lake (300 ha), and around Reed Lake (6200 ha).

Forest tent caterpillar egg-band surveys indicate that there may be a further general decline in the current outbreak areas in 1985, and no significant infestation is expected across the southern part of Manitoba.

Patches of moderate-to-severe defoliation of trembling aspen caused by the large aspen tortrix occurred in Birds Hill Provincial Park, and defoliation by the early aspen leaf curler occurred throughout the Spruce Woods Provincial Forest.

In **Saskatchewan**, there was a further decline of forest tent caterpillar populations, and moderate defoliation of trembling aspen and associated broadleaf hosts occurred over an area of 3000 ha compared to 350 000 ha in 1983 (Fig. 3). A few very small patches of severe defoliation were recorded in the Hazel Dell and Fishing Lake areas. Small isolated patches of generally moderate defoliation were observed in the Greenwater Provincial Park-Chelan area and at the Alberta-Saskatchewan border near Macklin. Light defoliation of trembling aspen was fairly common throughout other previously infested areas.

Egg-band surveys conducted at 15 locations indicate a further decline of forest tent caterpillar populations in 1985. Moderate defoliation is predicted to occur only in the Macklin area.

Other noteworthy aspen defoliators include the large aspen tortrix, which caused moderate-to-severe defoliation in most aspen stands in southern Saskatchewan. Generally low population levels occurred farther north. Low populations of the Bruce spanworm persisted in the Turtleford-Livelong area and caused patches of light-to-moderate aspen defoliation.

In **Alberta**, the forest tent caterpillar infestation decreased significantly, and moderate-to-severe defoliation of aspen occurred in patches over a total area of 1 335 000 ha compared to 3 998 000 ha in 1983, a

Table 3. Results of the 1984 jack pine budworm egg-mass survey in Manitoba and Saskatchewan and 1985 forecast

Location	Avg. no. of egg masses per 10 m²		Predicted defoliation for 1985
MANITOBA			
North of Grand Rapids			
Plot 1	103	(81)[a]	Moderate to severe
Plot 2	56	(35)	Moderate
Plot 3	70	(86)	Moderate
Plot 4	78	(191)	Moderate
Plot 5	182	(131)	Moderate to severe
Plot 6	371	(182)	Severe
Plot 7	95	(67)	Moderate
Plot 8	104	(34)	Moderate to severe
5 km south of Grand Rapids–Plot 9	55	(51)	Moderate
13 km south of Grand Rapids–Plot 10	62	(33)	Moderate
Rosenburg fire tower area (north of Arborg)		(0)	Nil
3 km south of Marchand Ranger Station	0	(0)	Nil
Nisto Lake	355		Severe
Guy Hill	95		Moderate
Westray	38		Light to moderate
Wallace Lake	77		Moderate
Belair	9		Light
Point du Bois	0		Nil
Rennie	0		Nil
Vassar	7		Light
SASKATCHEWAN			
2 km north of Nipawin	225		Severe
4 km northeast of Tobin Lake resort	166		Moderate to severe
Hudson Bay, south side	164		Moderate to severe
Nisbet Provincial Forest			
17 km west of Prince Albert	7		Light
North of Prince Albert airport	0		Nil
North of Macdowall	0		Nil
Fort à la Corne Provincial Forest	0		Nil
Between Denare Beach and Creighton	220		Severe
McBride Lake	14		Light
3.5 km east of Johnson Lake	76		Moderate
17 km north of Smeaton	0		Nil

[a] Figures in brackets are for 1983.

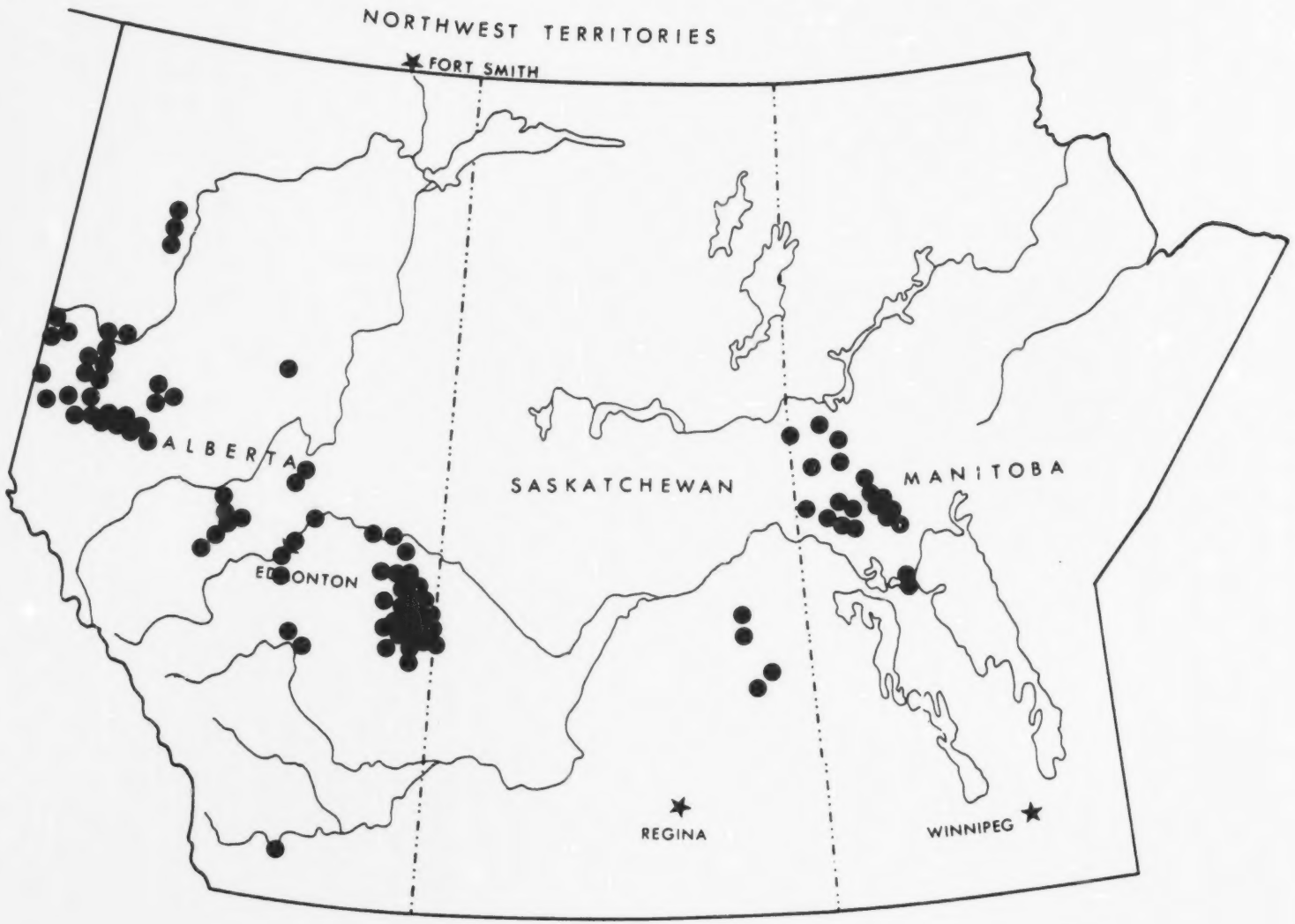

Figure 3. Areas of moderate-to-severe defoliation of trembling aspen primarily by the forest tent caterpillar in 1984.

decline of 67% in area. The current infestation is composed of two main outbreak areas. One area is located in east-central Alberta between Highways 13 and 16 and between the provincial border and Highway 881. This infestation was similar in size to that reported in 1983. The second area, in west-central Alberta, decreased considerably in 1984; however, moderate-to-severe defoliation occurred again between Grande Prairie and Valleyview. The infestation reported last year west of Edmonton collapsed in 1984 and defoliation occurred only in a small area east of Whitecourt.

Egg-band surveys were conducted at 53 locations in central Alberta to forecast forest tent caterpillar levels in 1985. The trend is for a continued decline in populations, and only 23% of the sample locations, compared to 35% in 1984, are forecasted to have moderate-to-severe defoliation.

In central Alberta, the early aspen leaf curler caused defoliation of aspen in Edmonton, Spruce Grove, Royal Park, Chauvin, Provost, Hardisty, Castor, and Big Knife Provincial Park and was present along with the linden looper in the Beaver Hills. In addition, the large aspen tortrix was found in the Porcupine Hills near Chain Lakes and in Waterton Lakes National Park in southern Alberta.

In the **Northwest Territories**, the large aspen tortrix infestation declined, but light defoliation of aspen occurred near Peace Point and Carlson Landing in Wood Buffalo National Park. The Bruce spanworm caused light defoliation of aspen near Enterprise.

MOUNTAIN PINE BEETLE
Dendroctonus ponderosae Hopkins

The outbreak of the mountain pine beetle in southwestern Alberta continued to decline in 1984 at most locations except in the Pole Haven area directly east of Waterton Lakes National Park and in many of the limber pine stands within and adjacent to the Porcupine Hills. Elsewhere, infestations occurred in most of the same areas as in 1983 in the Cypress Hills, the Kananaskis area, and in the Rocky Mountain national parks. Populations were reduced or at the same level at these locations except in Kootenay National Park, where an increased number of new fader trees was mapped in 1984.

Provincial forest lands: Mortality of lodgepole pine in 1984 occurred in over 200 infestations within an estimated 2500 ha distributed mostly south of the Crowsnest River in southwestern Alberta (Fig. 4). Within all areas south of the Crowsnest River an estimated 224 700 stems (equivalent to a volume of 74 150 m^3) were killed as a result of 1983 beetle attacks. This represents a slight decrease over that reported in 1983; however, over half of the total trees killed, or about 122 300 stems, were in the Pole Haven area alone on about 1300 ha.

In areas north of the Crowsnest River, including the Porcupine Hills and adjacent Livingstone Range, the total lodgepole pine mortality from 1983 attacks was about 5215 stems, or an estimated volume of 1720 m^3. Most of these were cut and burned by mid-July 1984 as part of the control program maintained by the Alberta Forest Service (AFS). An additional 24 000 limber pine trees attacked in 1983 within the Porcupine Hills and adjacent areas were also cut and burned to reduce beetle populations. An estimated 10 000 limber pine attacked in 1983 remained uncut and were distributed along the southeast side of the Porcupine Hills. The AFS control program of selective sanitation cutting and removal of beetle-infested trees will continue in 1985.

Salvage logging of lodgepole pine stands heavily damaged by the beetle was mostly completed in 1984 in areas south of the Crowsnest River. Since 1980 over 286 000 m^3 of affected lodgepole pine have been harvested.

Provincial parks: Infestations of the mountain pine beetle in provincial parks in the Cypress Hills of southwestern Saskatchewan and southeastern Alberta continued in the same locations as reported in 1983, but were much reduced (Fig. 4). A total of 225 red-topped trees was identified during aerial surveys over the Saskatchewan portion of the Cypress Hills in 1984 and about 300 red-topped trees on the Alberta portion. This represents a decrease from that reported in 1983, which can be attributed to the combined effects of the sanitation control program, low winter temperatures during 1983-84, and heavy woodpecker predation.

Both provinces are carrying out control programs by selective sanitation cuttings of beetle-infested trees. During the winter of 1984-85 less than 300 trees are likely to require control treatment, a reduction of 70% or more compared to the 3600 trees removed during 1983-84.

The infestations reported last year in Beauvais Lake Provincial Park have remained static or declined. In Kananaskis Provincial Park and adjacent areas, about 100 beetle-attacked lodgepole pine were cut and burned in 1984, and a similar number may be treated in 1985.

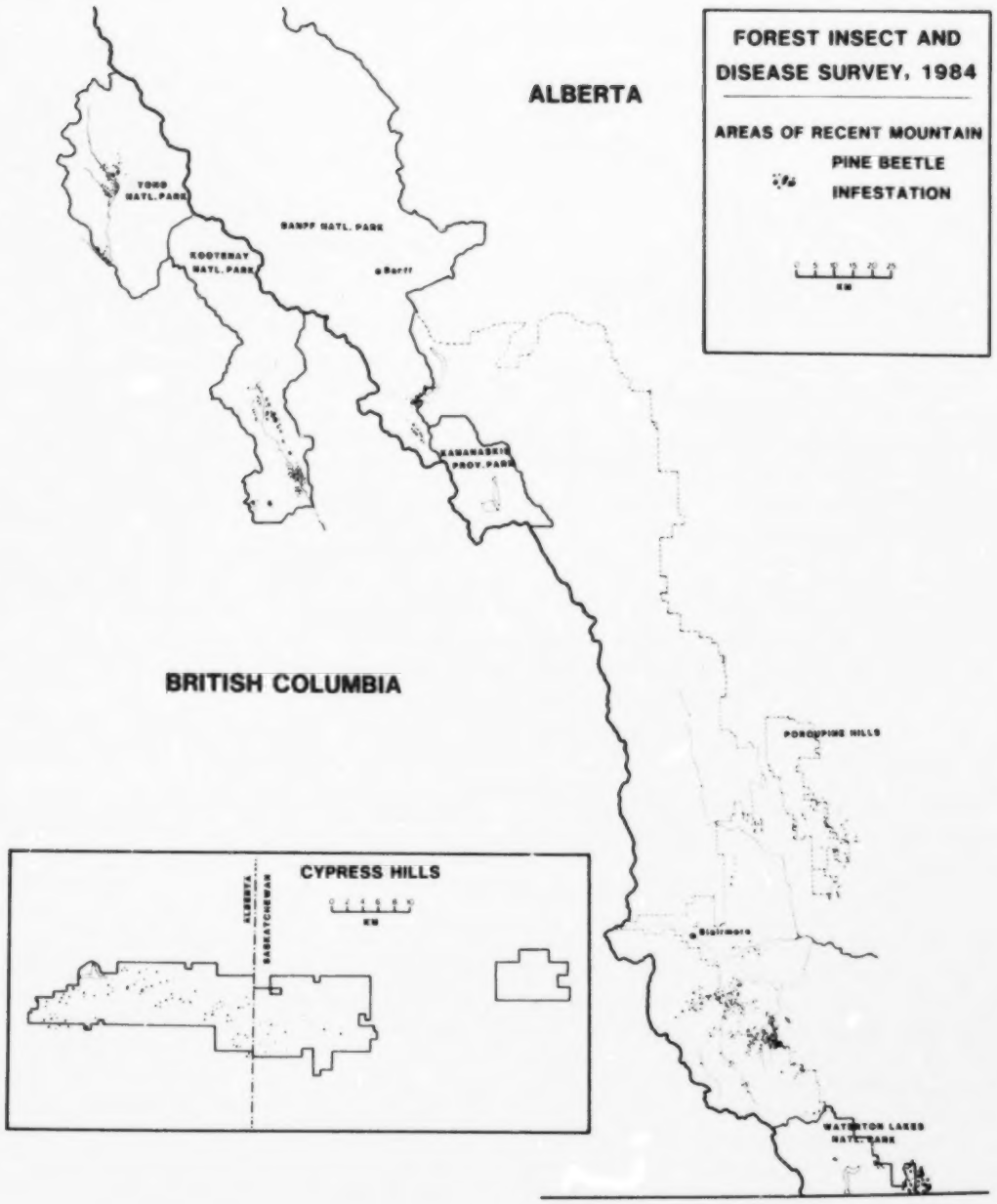

Figure 4. Areas of mountain pine beetle infestations in southwestern Alberta and the Cypress Hills on the Alberta-Saskatchewan border in 1984.

National parks: The number of recent beetle-killed trees in Yoho National Park in 1984 was estimated to be 350, slightly higher than in 1983. These trees were in the same areas as last year. In Kootenay National Park a total of 3600 new fader trees was estimated, an increase of about 2370 stems from 1983; however, about 590 of these dead trees occurred in the Red Streak Campground area near Radium, and some expansion occurred north of Daer Creek on Selkirk Mountain and near Pitt Creek. The number of new fader trees at Hector Gorge and near Kootenay Crossing, the two 1983-84 control sites, remained about the same as in 1983.

In Banff National Park about 185 new fader trees were identified in 1984 along the Spray River valley between the south park boundary and Spray Lake. All of the attacked trees are at a fairly high elevation, near 1830 m, and little evidence was found that successful broods had developed.

The outbreak in Waterton Lakes National Park declined further in 1984 and about 1000 new fader trees were observed along Blakiston and Cameron creeks and at the east park boundary.

During the winter of 1983-84, 40 beetle-infested trees were cut and burned near Kootenay Crossing and an additional 59 trees along the Spray River in Banff National Park. A similar number of trees has been identified in each park for possible control treatment in 1984-85.

A commercially prepared lure containing semiochemicals (behavior-modifying chemicals) of the mountain pine beetle was used for the second consecutive year by provincial agencies in the Cypress Hills and in southwestern Alberta. Approximately 3200 lures were deployed as tree baits in susceptible pine stands to aid in detecting residual populations within control zones and as a means of attracting and concentrating adult beetles onto trap trees. Ratios of number of trees attacked to number of baited trees at each of three main locations indicated that overall populations declined by 70-85% from 1983 to 1984. At one of the locations average attack density on baited trees declined from 102 attacks per square metre of bark surface in 1983 to 29 per square metre in 1984. The application of the pheromone baits has helped to quantify the effects of the control programs and has facilitated collection of beetle populations into known locations for direct removal treatment.

SPRUCE BEETLE
Dendroctonus rufipennis (Kirby)

Spruce beetles occur throughout much of the spruce-forested areas of the three prairie provinces and Northwest Territories, where they are often present in low numbers in localized areas in wind-thrown spruce, fresh-cut stumps, and logs. Periodic outbreaks have developed in the past in northern and southwestern Alberta, and all apparently have originated from blowdowns, cull logs, or right-of-way logging operations. Stands of Engelmann and white spruce over 120 years old appear to have been the most susceptible.

The most recent outbreak, which began in about 1977 in northwestern **Alberta**, has caused accumulated tree mortality ranging from 5 to 70% over a composite area of at least 100 000 ha in the Footner Lake and Peace River forest districts. Various aerial and ground surveys conducted in 1984 suggest that spruce beetle populations have now declined substantially throughout these two forest districts and persist partly in small groups of one to three standing trees. Major stands affected are located near Rainbow Lake, along the Chinchaga River west and southwest of High Level, on Watt Mountain, and in the Naylor and Hawk hills near Keg River. Numerous smaller (less than 50 ha each) stands with evidence of beetle-killed trees occur along the Peace River southeast and east of High Level, along the Wabasca River near its confluence with the Peace River, and along the ridge south of Zama and Hay lakes.

In Wood Buffalo National Park, estimated white spruce mortality of 8-10%, cumulated over several recent years, occurs along the Peace River between Jackfish River and the western park boundary.

Control of the spruce beetle in the Footner Lake Forest has commenced by first identifying priority stands with 10% or more mortality, followed by subsequent salvage logging. During the winter of 1983-84 salvage logging was undertaken in three main infestation areas near the Rainbow Lake townsite and along the Chinchaga River. Of the total volume of spruce salvaged, an estimated 19% or 47 500 m^3 had been killed by the spruce beetle; however, this value excludes an additional estimated volume of 33 340 m^3 of beetle-killed trees left unsalvaged because of their advanced deterioration. Salvage operations are continuing in the Footner Lake and Peace River forest districts during 1984-85.

Low endemic populations also occur in the Grande Prairie, Slave Lake, Whitecourt, Athabasca, and Bow-Crow forests but pose no immediate threat. In the Bow-Crow Forest, where 17 Engelmann spruce sites were monitored by the province for spruce beetle, less than 120 trees (less than 2% incidence) were identified with 1984 attacks, a decline of about 18% over that reported in 1983.

Within the Rocky Mountain national parks, no 1984-attacked spruce were observed near Cameron Lake, Waterton Lakes National Park, but spruce beetle populations were found in wind-thrown trees at Hoodoo Creek Campground, Yoho National Park.

In **Saskatchewan**, no spruce beetles were observed in white spruce examined in Meadow Lake Provincial Park.

DUTCH ELM DISEASE
Ceratocystis ulmi (Buisman) C. Moreau

Dutch elm disease (DED) continued to be a serious problem of native and planted white elms in **Manitoba**, though it has infected only one elm in southern Saskatchewan in 1981, and has not been detected in Alberta. Dutch elm disease surveys were conducted primarily by the Manitoba Department of Natural Resources with cooperation from the CFS and Parks Canada. The Province reported that DED was recorded for the first time in the rural municipality of Coldwell and in the local government districts of Fisher and Armstrong, increasing the number of municipalities with the disease from 59 in 1983 to 62 in 1984 (Fig. 5). Although DED continues to increase in wild stands, the number of diseased elms in urban centers with control programs was low. Less than 1% of the elms in Winnipeg and less than 2% of the elms in Brandon were infected. Most of these diseased trees are found in wild stands along the river valleys, where control measures are less effective. The native elm bark beetle, *Hylurgopinus rufipes* (Eichhoff), is still the primary vector of the disease in Manitoba. A few adults of the European elm bark beetle, *Scolytus multistriatus* (Marsham), were collected in Winnipeg. In 1984 Parks Canada detected and removed eight more infected trees near the Whirlpool warden station in Riding Mountain National Park, where the disease was first detected in 1983.

In **Saskatchewan** an investigation of numerous dead, dying, and declining native white elm was conducted by FIDS staff. The elms are located in the Squaw Rapids-Cumberland House area in north-central Saskatchewan. The dead or dying trees were infested with the native elm bark beetles but the disease was not found. Other factors such as physiological and mechanical injury were believed to have contributed to the decline of white elms in the area.

In **Alberta**, the annual surveys by Alberta Agriculture and FIDS staff were conducted in 1984. Pheromone-baited traps and trap logs were deployed at various locations throughout southern Alberta but the two insect vectors were not detected.

DWARF MISTLETOES
Arceuthobium americanum Nuttal ex Engelmann on jack and lodgepole pines and *A. pusillum* Peck on white and black spruces

Dwarf mistletoes on pines and spruces are a perennial problem in the prairie provinces and cause witches' brooms, stem deformation, reduced growth, and tree mortality, especially in jack pine stands.

In northeastern **Alberta**, the dwarf mistletoe sanitation program by the AFS was continued in selected areas of jack pine burned by forest fires during the past 5 years. Residual stands with mistletoe infections within the burn areas are being removed to reduce early infection in the surrounding regeneration.

In **Saskatchewan**, study plots were established in the Nisbet Provincial Forest to determine the effects of various degrees of dwarf mistletoe infections on tree growth. The Saskatchewan Department of Parks and Renewable Resources has also initiated intensive sanitation control treatments in several jack pine forests.

In **Manitoba**, the Forestry Branch of the Manitoba Department of Natural Resources has initiated an intensive dwarf mistletoe management program. Ground surveys to locate potential treatment areas were concentrated in the Moose Lake, Grand Rapids, Esterville, and Swan River areas and the Belair Provincial Forest. Two basic treatment programs are being conducted: post-harvest cleanup, and sanitation thinning and pruning in young stands. Currently, the Province has identified seven areas for dwarf mistletoe treatment in the Belair Provincial Forest, Porcupine Provincial Forest, the Cowan and Kettle hills in the Western Region, Easterville in the Interlake Region, Moose Lake in the Northwestern Region, and Grand Rapids.

In the **Northwest Territories** light, sporadic infections of dwarf mistletoe on jack pine occur throughout the

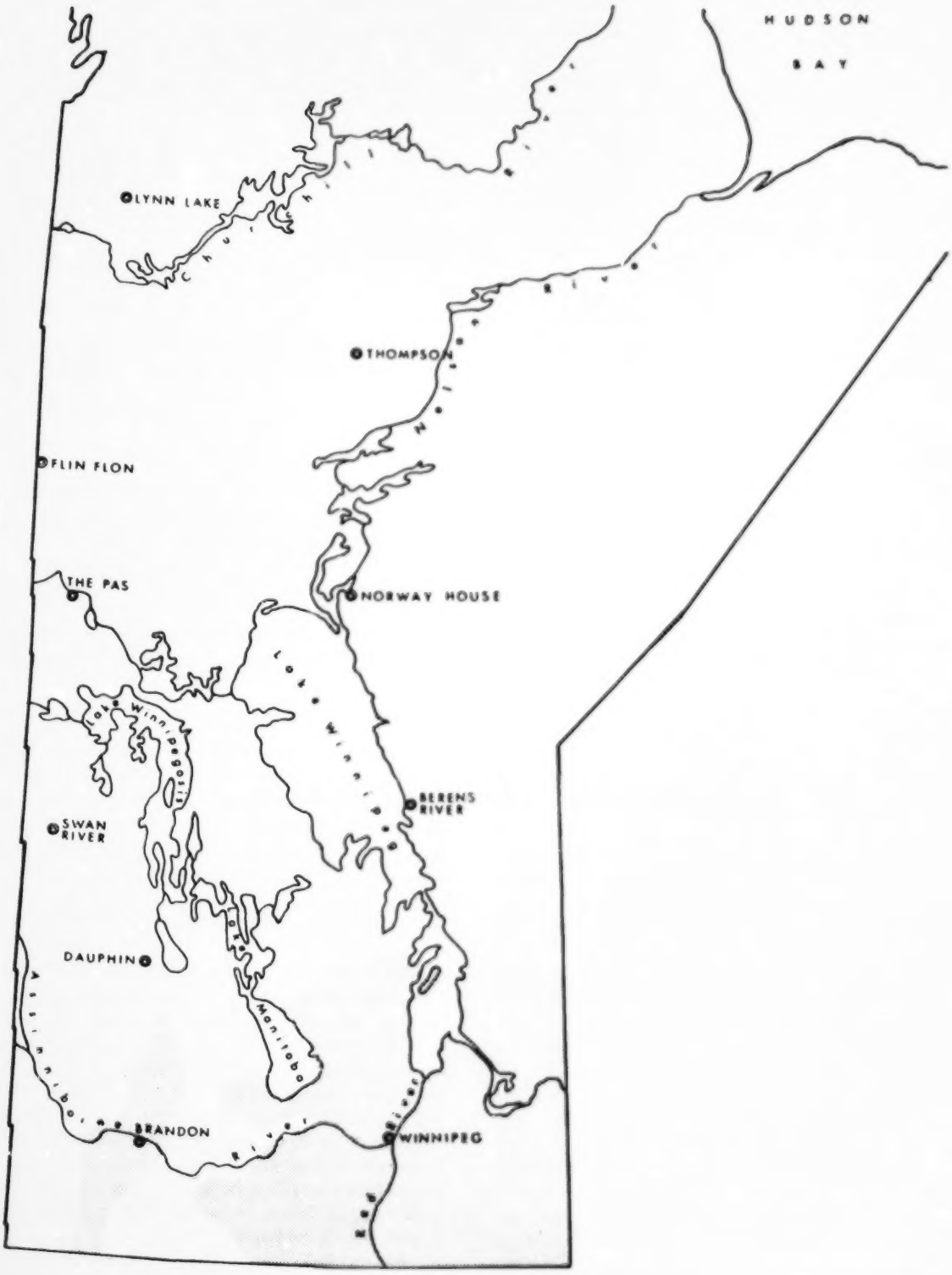

Figure 5. Areas of Dutch elm disease infections in Manitoba in 1984.

MacKenzie District with moderate to severe witches' brooms occurring approximately 180 km north of Fort Providence on Highway 3 and east of Fort Simpson and Fort Laird.

LARCH SAWFLY
Pristiphora erichsonii (Hartig)

In the **Northwest Territories** light to moderate larch sawfly populations were found throughout the MacKenzie District in 1984. Notable areas of moderate-to-severe defoliation occurred between Rae and Yellowknife, from the Alberta-NWT border to Enterprise, and between Fort Simpson and Nahanni Butte on Highway 7 for approximately 120 km. Smaller patches of larch sawfly infestation, 1-10 km wide, occurred near Chan Lake on Highway 3, east of Hay River, and near Fort Smith along Highway 5. Excessive surface moisture in the spring and early summer of 1984 may have contributed to some pupal mortality.

Larch sawfly defoliation was scattered and light throughout Wood Buffalo National Park. A few trees were moderately defoliated between Fitzgerald and Pine Lake junction.

In **Manitoba**, moderate-to-severe defoliation of larch forests was detected along the Thompson Highway in the Ponton area, south of Chitek Lake, and along Highway 10 south of the Easterville turnoff.

PINE NEEDLE CAST
Lophodermella concolor (Dearn) Darker

This needle cast fungus caused considerable needle loss on lodgepole pine in shelterbelts at several locations in central **Alberta**. Infection levels remained low in most forest areas inspected. In Banff National Park, infection of 1983 foliage was moderate-to-severe and was associated with the lodgepole needle miner, *Coleotechnites starki* (Freeman). The fungus caused considerable needle loss of pine between Saskatchewan Crossing and Nigel Creek. Throughout Jasper National Park moderate-to-severe infections occurred on many individual trees.

LODGEPOLE NEEDLE MINER
Coleotechnites (Eucordylea) starki (Freeman)

In Banff National Park, combined effects of the pine needle cast and the lodgepole needle miner caused notable loss of foliage in the Saskatchewan River valley between Saskatchewan Crossing and Nigel Creek. Because moths are produced in odd-numbered years, 1984 was a nonflight year and the needle miner populations remained moderately high. In Kootenay National Park, moderate-to-severe defoliation of the needle miner associated with a needle cast caused considerable needle loss between Vermilion Crossing and Paint Pots.

INTRODUCED INSECTS

A survey was made in 1984 for several introduced insects that have entered southeastern **Manitoba** in recent years. The distribution of the introduced pine sawfly, *Diprion similis* (Hartig), first collected in 1983, remained unchanged. The European spruce sawfly, *Gilpinia hercyniae* (Hartig), has been present since 1969 and appeared to have increased in numbers but not in distribution. In some areas of southern Manitoba, it was collected more frequently than the native green-headed spruce sawfly, *Pikonema dimmockii* (Cresson). The larch casebearer, *Coleophora laricella* (Hartig), present since 1965, has apparently not increased in numbers or extended its range from last year.

Surveys were also conducted to determine if certain introduced insects present in Ontario have spread to the prairie provinces. The mountain ash sawfly, *Pristophora geniculata* (Hartig), has now spread to **Manitoba** and was collected for the first time at Falcon Lake in 1984. The European pine shoot moth, *Rhyacionia buoliana* (Dyer & Shannon), present in Ontario and British Columbia, is absent in the prairie provinces based on pheromone trapping. The Gypsy moth, *Lymantria dispar* (Linnaeus), was collected for the first time in **Alberta**. A male gypsy moth was captured in a pheromone-baited trap set out by Agriculture Canada at Sherwood Park near Edmonton. Additional pheromone traps will be set out in 1985 to determine if this destructive insect has become established in Alberta.

ACID RAIN MONITORING

A new role for FIDS was initiated in 1984 as part of an Acid Rain National Early Warning System (ARNEWS). The objective is to monitor forests for changes and damage that may occur over many years to the forest vegetation as a result of acid rain. FIDS will be working closely with other CFS and provincial agencies on the project. Initial monitoring will be at plots located

near existing biomonitoring plots established earlier under the CFS Toxic Substances project at Fort McMurray and Rocky Mountain House in **Alberta** and near Flin Flon and Thompson in **Manitoba**. Additional plots will be established in 1985 in pine, spruce and aspen stands in Alberta, Saskatchewan, and Manitoba.

SELECTED PUBLICATIONS AND REPORTS

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OTHER INSECTS AND DISEASES

Insect or disease	Host	Location	Remarks
Armillaria root rot *Armillaria mellea* (Vahl ex Fries) Kummer	Pine	Prairie provinces	Low but significant tree mortality in natural regeneration and plantations. In Manitoba, extensive tree mortality is occurring in red pine plantations.
Bark beetle *Hylurgops rugipennis* (Mannerheim)	Jack pine	NWT Alberta	Found associated with other organisms in small patches of recently killed jack pine in the NWT.
Birch leaf miners *Fenusa pusilla* (Lepeletier) *Heterarthrus nemoratus* (Fallen) *Profenusa thomsoni* (Konow)	Birch species	Prairie provinces	Continued to cause moderate-to-severe leaf injury in urban areas and increased damage in some forested areas, caused mostly by *P. thomsoni*, especially in northern Manitoba.
A Birch leaf skeletonizer *Lyonetia* species (probably *L. prunifoliella* Hübner)	Birch	Yoho National Park	Infestation on white birch collapsed after 3 consecutive years of severe foliage damage.
Bruce spanworm *Operophtera bruceata* (Hulst)	Aspen	Saskatchewan Alberta NWT	Light infestations in a few areas.
Chemical injury	Several species	Prairie provinces	A slight increase in reports of mortality and injury to non-target trees by chemicals, especially soil sterilants in urban areas.
Comandra blister rust *Cronartium comandrae* Peck	Pine	Alberta NWT	Low level of infections in pine regeneration areas. Widely distributed on jack pine in the NWT.
Cytospora canker *Cytospora chrysosperma* Persoon ex Fries	Poplar	Alberta Saskatchewan	Common on native trees and hybrid poplar shelterbelts in several areas.

Other insects and diseases, continued

Insect or disease	Host	Location	Remarks
Drought injury	Several species	Alberta Saskatchewan	Common in southern half of Saskatchewan and in the Lethbridge and Medicine Hat areas of Alberta.
Eastern black-headed budworm *Acleris variana* (Fernald)	Spruce	Prairie provinces	Common in Yoho, Jasper, and north end of Banff national parks, causing light damage. Very light defoliation in central Saskatchewan.
Fall cankerworm *Alsophila pometaria* (Harris)	Manitoba maple White elm Green ash	Manitoba Saskatchewan Alberta	Extensive patches of moderate-to-severe defoliation common in southern Manitoba and central Saskatchewan. Low population levels reported in southern Alberta.
Fire blight *Erwinia amylovora* (Burrill) Winslow *et al.*	Apple Cotoneaster Crab apple Hawthorn Mountain ash	Major urban centers	A noticeable decrease of infections in Saskatchewan and Alberta.
Frost damage	Several species	Prairie provinces NWT	Frost injury was common in several areas, especially on spruce and hybrid poplars in southwestern Saskatchewan and western Manitoba.
Hypoxylon canker *Hypoxylon mammatum* (Wahlenberg) J.H. Miller	Aspen	Prairie provinces	Light-to-moderate infection common throughout host range.
Larch casebearer *Coleophora laricella* (Hübner)	Larch	Manitoba	Moderate-to severe defoliation occurred in three areas of Manitoba.
Large aspen tortrix *Choristoneura conflictana* (Walker)	Aspen	Alberta Saskatchewan	Continuance of light, moderate, and severe damage in the Cypress Hills, Saskatchewan and Alberta, and southern Alberta, respectively.

Other insects and diseases, continued

Insect or disease	Host	Location	Remarks
Lodgepole terminal weevil			
Pissodes terminalis Hopping	Pine	Prairie provinces	Infestations are common on young trees throughout the provinces. One plantation in Manitoba had 85% (cumulated over several years) of jack pine trees with top kill.
Northern pitch twig moth			
Petrova albicapitana (Busck)	Jack pine	Prairie provinces	Primarily *P. albicapitana* caused numerous top and branch kill on young pine trees.
P. metallica (Busck)	Lodgepole pine	NWT	
Pear sawfly			
Caliroa cerasi (Linnaeus)	Mountain ash Cotoneaster Apple Plum	Alberta Saskatchewan	Remains a persistent and sometimes serious leaf skeletonizer of many urban plants.
Pine engraver			
Ips pini (Say)	Jack pine Lodgepole pine	Prairie provinces NWT	Light infestations in weakened trees throughout the region.
Pine needle cast			
Lophodermella concolor (Dearn) Darker	Lodgepole pine	Alberta	Continues to be responsible for considerable needle loss on urban plantings and shelter belts in central Alberta. Infection levels remained low in most forested areas.
Pine root-collar weevil			
Hylobius radicis Buchanan	Pine	Southeast Manitoba	Occurs in low numbers in pine plantations.
Pinewood nematode			
Bursaphelenchus xylophilus (Steiner and Buhrer) Nicle	Jack pine	Manitoba	First identified from two dead jack pines in 1982, the nematode was again identified in 1984 in dying or dead trees attacked by *Monochamus* spp. in two stands in the Belair Provincial Forest.
Rabbit damage	Lodgepole pine Jack pine Spruce	Prairie provinces	Light tree mortality near Pine Lake, Wood Buffalo National Park. Very light throughout the provinces.

Other insects and diseases, continued

Insect or disease	Host	Location	Remarks
Red belt injury	Pine Fir	NWT	Moderate-to-severe injury to pine and fir on the east slope of Mackenzie Mountains, NWT.
Sawyer beetles, mainly *Monochamus scutellatus* (Say)	Lodgepole pine Jack pine White spruce Black spruce	Region wide	Adult feeding in northwestern Manitoba around jack pine clear-cuts; variable wormhole damage in fire-killed timber.
Scleroderris canker *Gremmeniella abietina* (Lagerberg) Morelet	Lodgepole pine	Alberta	Found only in known areas in Jasper National Park.
Silver leaf *Stereum purpureum* (Persoon) Fries *(Chondrostereum p.)*	Mountain ash Apple Cotoneaster Other species	Prairies provinces	Continued to be a common problem in urban areas and older farmsteads.
Spruce gall aphids *Adelges cooleyi* (Gillette) *Pineus similis* (Gillette) *Pineus pinifoliae* (Fitch)	Spruce Pine	Prairie provinces and NWT	Damage light but common in several areas. Aphids on pine, the secondary host, increased in urban areas.
Spruce needle rust *Chrysomyxa* sp.	Spruce	Eastern Manitoba	Occasional patches of moderate-to-severe browning of foliage.
Spruce spider mite *Oligonychus ununguis* (Jacobi)	Spruce Juniper Cedar	Prairie provinces	Continued as the most reported spruce pest in urban areas and is a perennial problem.
Two-year-cycle spruce budworm *Choristoneura biennis* Freeman	Alpine fir Engelmann spruce	B.C.	Light damage in northern Kootenay National Park.
Western gall rust *Endocronartium harknessii* (J.P. Moore) Y. Hiratsuka	Lodgepole pine Jack pine	Prairie provinces	Common at low levels in most young pine regeneration, plantations, and on some urban trees.

Other insects and diseases, continued

Insect or disease	Host	Location	Remarks
White pine weevil *Pissodes strobi* (Peck)	Spruce Pine	Prairie provinces	Infested dead tops were common on young trees throughout the region. Top kill also occurred on pines and spruces in several provincial nurseries and plantations.
Willow leaf miner *Lyonetia* sp.	Willow	Prairie provinces NWT	Patches of moderate-to-severe damage common in northern Manitoba. Moderate to severe in many scattered areas in central Saskatchewan and light Alberta. Moderate-to-severe leaf mining near Fort Liard, NWT.
Winter drying	Several species	Prairie provinces	Light-to-severe damage occurred sporadically on several conifers. Reddening of balsam fir and jack pine was fairly extensive east of Lake Winnipeg.
Yellow-headed spruce sawfly *Pikonema alaskensis* (Rohwer)	Spruce	Prairie provinces NWT	Generally, light injury occurred throughout the region. Moderate-to-severe injury in shelterbelts and in urban areas in Saskatchewan and Alberta. Moderate-to-severe defoliation of scattered white spruce reproduction occurred in central Manitoba.